



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,366	06/19/2001	Toshiya Ishio	1035-330	1077
23117	7590	01/25/2006	EXAMINER	
NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203			IM, JUNGHWA M	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 01/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

EF

Office Action Summary	Application No. 09/883,366	Applicant(s) ISHIO ET AL.	
	Examiner Junghwa M. Im	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,5-7,10,17-19,21-26,28 and 31-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,5-7,10,17-19,21-26,28 and 31-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 5-7, 10, 17-18, 21-26, 28 and 31-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani et al. (US 6656828), hereinafter Maitani in view of Iannuzzi et al. (US 4176443), hereinafter Iannuzzi.

Regarding claims 1, 6-7 and 17, Fig. 5 of Maitani shows a semiconductor device comprising:

a main conductor layer/a wiring layer (6; Cu) having an end that is electrically connected to an electrode pad (BP);

an insulating layer (3) having an opening section on said main conductor layer;

a protrudent electrode (2) electrically connected to the main conductor layer via said opening section, the bump made of a metal having Sn as its main component (col. 7, line 51);
and

a metal layer (14, 15) provided completely covering a bottom surface, but not completely covering side surfaces, of the opening section on the main conductor layer so that said metal layer is provided between said main conductor layer and the protrudent electrode, wherein

said metal layer includes a nickel layer (14) and the gold layer (15), wherein

said nickel layer is made of Ni by electroless plating (col. 7, lines 33-35); and

Art Unit: 2811

said gold layer is made of Au.

Fig. 5 of Maitani shows most aspect of the instant invention except a Ni layer (barrier layer) formed only in the opening. The figure of Iannuzzi shows a Ni layer (4; a barrier layer) formed only in the opening for the Sn bump connection.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Iannuzzi into the device of Maitani in order to have a Ni layer only in the opening to reduce the packaging size.

Regarding claim 5, Maitani discloses the metal layer has a thickness ranging from 0.003 μm to 1 μm (col.9, lines 56-57).

Regarding claim 10, Fig. 5 of Maitani shows a foundation metal layer (13) made of Ti, Ti-w, Cr, or a metal having any of those elements as its main component, under the main conductor layer (col.7, line 23).

Regarding claim 18, Fig. 5 of Maitani shows the main conductor/wiring layer comprises first (6) and the second (13) metal layers.

Regarding claim 21, Maitani discloses the metal layer has a thickness ranging from 0.003 μm to 1 μm (col.9, lines 56-57).

Regarding claim 22, Fig. 5 of Maitani shows a protruding electrode bump.

Regarding claim 23, Fig. 5 of Maitani shows the conductive wiring layer is connected to the electrode pad (BP) via an opening formed in another insulating layer.

Regarding claim 24, Maitani discloses that the other insulating layer comprises an inorganic layer (10, 11; SiO_2 ; col. 7, line 66) and an organic layer (4; polyimide; col. 6, line 13).

Art Unit: 2811

Regarding claims 25, 28 and 35, Fig. 5 of Maitani shows a semiconductor device comprising:

a semiconductor device comprising:

a conductive wiring layer (6) connected to an electrode pad (BP), an insulating layer (3; polyimide resin) on the conductive wiring layer having an opening which exposes an upper portion of the conductive layer, a metal layer (15) having lateral dimensions by the size of the opening, completely covering the upper surface of the conductive wiring layer in the opening section but not completely covering the sides of the opening, and a bump electrode (2) being mainly made of Sn electrically connected to the conductive wiring layer via said opening section; and

wherein the conductive wiring layer comprises first (6), second (13) and the third (14) metal layers, the third layer (14; Ni) having low reactivity with the insulating layer.

Fig. 5 of Maitani shows most aspect of the instant invention except a Ni layer (barrier layer) formed only in the opening. The figure of Iannuzzi shows a Ni layer (4; a barrier layer) formed only in the opening for the Sn bump connection.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Iannuzzi into the device of Maitani in order to have a Ni layer only in the opening to reduce the packaging size.

Regarding claims 26, 31 and 33, Fig. 5 of Maitani shows a top metal layer (15) comprises Au (col.7, lines 57-58), therefore having good wettability to the electrode.

Art Unit: 2811

Regarding claim 32, Maitani shows substantially the entire claimed structure except the barrier metal layer in the opening. The figure of Iannuzzi shows Au-Ni layer formation in the opening of the insulating layer by electroplating (col. 9, lines 32-40).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teachings of Iannuzzi into the device of Maitani in order to have a Ni layer only in the opening to reduce the packaging size. It is noted that Maitani discloses Au wettability and the Ni barrier layer by electroless plating as discussed above.

Regarding claims 36-38, Fig. 5 of Maitani shows that nickel layer (barrier layer) is made of Ni by electroless plating (col. 7, lines 33-35). In addition, it is pointed out that “by electroless plating” is a process designation, and would thus not carry patentable weight in this claim drawn to a product. *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Maitani and Iannuzzi as applied to claim 18 above, and further in view of Greer (US 6451681).

Regarding claim 19, the combined teachings of Maitani and Iannuzzi show substantially the entire claimed structure except “the first layer having a barrier layer and an adhesion layer.” Fig.3 of Greer shows the first layer having a barrier layer (122) and an adhesion layer (200).

It would have been obvious to one of ordinary skill in the art to incorporate the teachings of Greer into the device of Maitani and Iannuzzi in order to have a multi-layered metal layer to improve the connection between the bump and the wiring layer.

Response to Arguments

Art Unit: 2811

Applicant's arguments filed October 31, 2005 have been fully considered but they are not persuasive.

Applicants argue that “Consequently, the Ni layer 4 (second intermediate layer) of Iannuzzi et al. is formed by vapor deposition, not electroless plating. As such, Iannuzzi et al. clearly does not contain the technical idea that the Ni layer 4 is formed by electroless plating as specified, for example, in claim 1.” Note that Iannuzzi is not relied on in the rejection for this teaching. The teachings of Iannuzzi are referred merely to show a Ni layer is formed in an opening. And it is pointed out that “by electroless plating” is a process designation, and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985). Furthermore, Maitani discloses that the Ni layer is formed by electroless plating (col. 7, lines 33-35). Therefore, the Ni layer in the device of Maitani can be formed only in the opening with the incorporation of the teachings of Iannuzzi wherein the Ni layer is formed in the opening.

Applicants argue that “In summary, Iannuzzi et al. is different from the pending claims and from Maitani et al. in its technical idea and at best suggests an arrangement in which an Ni layer formed by deposition is provided in a region at least including an opening section on a metallic layer which is not made of Cu.” It is noted that the teachings of Iannuzzi is referred merely to show a Ni layer is formed in an opening to improve the bonding property of the metal layer underneath as disclosed in the reference of Iannuzzi. Additionally, the instant invention recites device claims, therefore, a technical idea in claims does not carry a patentable weight. Furthermore, the instant invention does not recite limitations which reflect any of technical ideas.

Applicants argue that “The office action states that the basis for modifying Maitani et al. based on Ianuzzi et al. is to “reduce the packaging size”. However, there is no evidence identified in the office action that a reduced packaging size would result from the proposed combination and Applicants respectfully submit that one of ordinary skill in the art would not have looked to Ianuzzi et al. to reduce packaging size as proposed.” It is noted that is a common sense to one of ordinary skill in the art that the package size would be reduced if a Ni layer is formed only in the opening rather than covering the entire Cu layer. That is, the Ni layer 14 would be formed only in the opening with the teachings of Iannuzzi. And the insulating layer 3 would be directly on the Cu layer, therefore a thickness of the interconnection layer would be reduced.

Applicants argue that “In addition, the office action does not explain what would motivate one of ordinary skill to modify Maitani et al., which already includes an Ni layer 14, to provide another Ni layer such as Ni layer 4 of Ianuzzi et al.” As discussed above, a replacement of a Ni layer would be in the opening, not on the entire Cu layer. Therefore, the combined teachings of Maitani and Iannuzzi would have a Ni layer only in the opening without providing another Ni layer.

Applicants argue that “The office action treats Maitani et al. and Ianuzzi et al. with an improper hindsight view to construct the features of the claims.” Note that it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge

Art Unit: 2811

gleaned only from the applicant's disclosure, such a reconstruction is proper. *In re McLaughlin*, 443 F.2d 1392; 170 USPQ 209 (CCPA 1971).

Applicants argue that "In the proposed combination, the office action fails to take into account, for example a material of the layer on which the Ni layer is laminated and the step of forming the Ni layer." It is pointed out that the instant invention recites a limitation of 'a semiconductor device *comprising* ... metal layer *including* a Ni layer and a Au layer in the opening ...' This limitation implies that the metal layer in the opening is not necessarily Ni and Au only. And "a step of forming the Ni layer" is a process designation, and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Applicants further argue contending on the issues regarding a different method involved in the instant claim. However, even though product by process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698 USPQ 964, 966 (Fed. Cir. 1985).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

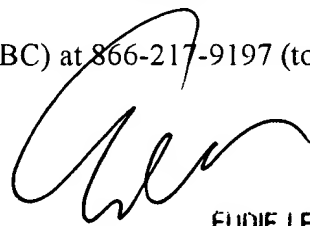
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's acting supervisor, Eddie C. Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jmi



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800